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Roysia House

John Street, Royston

Internal Building Fabric Report

Report **13081-IBF-01**

Prepared on 18 December 2017

Issued For:

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1st Floor Jasmin House
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1.0 INTRODUCTION

Current proposals are to redevelop the site at Roysia House, John Street, Royston to comprise residential apartments. As part of the redevelopment, an existing 1st floor nightclub will be converted to provide residential apartments.

Clement Acoustics Ltd has been commissioned by Suralex Estates Ltd to carry out acoustic measurements and assessments of a separating floor between a retained ground floor restaurant, and the existing nightclub, which will be changed to flats.

This report provides the methodology and results from the surveys and presents any recommended noise mitigation measures.

2.0 SITE DESCRIPTION

Residential apartments will be located on 1st floor and above at Roysia House, John Street, Royston. The 1st floor space is located above a ground floor restaurant, which will be retained.

The area is predominantly commercial in nature, located in the centre of Royston. Roysia House is bound by Jepps Lane to the north, John Street to the south, a parking area to the east and commercial buildings to the west.

Sound insulation tests and assessment have been undertaken of the floor which will separate the ground floor restaurant from 1st floor flats following development works.

3.0 CRITERIA

BS 8233:2014: '*Guidance on sound insulation and noise reduction for buildings*' describes recommended acceptable internal noise levels for residential spaces during daytime and night-time hours. These levels are shown in Table 3.1.

Activity	Location	Design range $L_{eq,T}$ dB	
		Daytime (07:00-23:00)	Night-time (23:00-07:00)
Resting	Living Room	35 dB(A)	-
Dining	Dining Room/Area	40 dB(A)	-
Sleeping	Bedroom	35 dB(A)	30 dB(A)

Table 3.1: BS8233 recommended internal background noise levels

Although the restaurant is only open as late as 23:00on Saturdays, and typically 22:30 on other nights, an assessment will be undertaken for night-time hours in order to present a robust assessment.

Further, in order to compensate for the potentially tonal nature of noise levels in the restaurant, the design criterion will be considered in terms of a noise rating level.

In order to ensure a level of 30 dB(A) is not exceeded in residential apartments, we therefore proposed a criterion of NR20.

4.0 ANTICIPATED NOISE LEVELS

Noise measurements were carried out at a similar restaurant in order to ascertain typical worst case source noise levels.

A Class 1 sound level meter was used to measure noise levels during an evening period with the restaurant busy, alcohol being served and with background music.

Measurements of approximately 1 minute were carried out. Table 4.1 presents the loudest noise levels measured.

Measurement Type	Sound Pressure Levels in each Frequency Band								
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dB(A)
Measurement In Restaurant, Close to Bar									
$L_{Aeq, T}$	75	76	77	76	80	77	71	62	83

Table 4.1: Worst Case Noise Levels at Similar Bar/Restaurant

5.0 SOUND INSULATION PERFORMANCE OF EXISTING SEPERATING FLOOR

Sound insulation testing was carried out on 7 December 2017 as described below. The testing was carried out between the ground floor and first floor levels before any structural works had commenced.

5.1 Airborne Tests

High volume "white" noise was generated from a loudspeaker in the source room, positioned in order to obtain a diffuse sound field. A spatial average of the resulting one-third octave band noise levels between 50 Hz and 10 Hz was obtained by using a moving microphone technique over a minimum period of 15 seconds at each of two positions.

The same measurement procedure was followed in the receiver room.

5.2 Background Noise

Background noise levels in the receiver rooms were measured during the tests and the receiving room levels corrected in accordance with BS EN ISO 140 Part 4.

The dominant source of background noise observed during the tests was road traffic noise from surrounding roads.

5.3 Instrumentation

The instrumentation used during testing is shown in Table 5.1 below.

Instrument	Manufacturer and Type	Serial Number
Sound level meter	01dB-Stell Black Solo	65785
Active Loudspeaker	RCF ART 310A	GEX05725
Calibrator	Norsonic Type 1251	31716
Specialist Software	01dB-Metravib dBBati	V5.050

Table 5.1: Instrumentation used During Testing

5.4 Results

The results of testing are summarised in the tables below. For airborne tests, the higher the value, the better the performance.

The summarised results of the airborne tests are shown in Table 5.2.

Level Difference dB, Hz															
100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k
36	39	44	42	44	42	47	50	50	54	58	61	63	61	58	58

Table 5.2: Level Difference of Separating Floor

The weighted level difference, D_w, was then calculated as presented in Table 5.3

Test Element	Source	Receiver	Test Result
Floor	Basement	Ground Floor	D_w 54 dB

Table 5.3: Weighted Level Difference Result

6.0 NOISE BREAKOUT ASSESSMENT

In order to predict the transmission of noise to proposed residential spaces, calculations have been undertaken using the following standard acoustic formula:

$$SPL_{receiver} = SPL_{source} - SRI_{separation} + 10\log_{10} S - 10\log_{10} A$$

Where:

- SPLsource is the measured source noise in a similar bar/restaurant [*Table 4.1*]
- $SRI_{seperation}$ is the measured sound reduction of the floor [*Table 5.2*],
- S is the area of the transmitting floor,
- and A is the absorption area of the receiving room [*0.5 s absorption coefficient*].

Taking all above factors into account, the predicted transmission level of noise to residential spaces would be as shown in Table 6.1. Detailed spectral calculations are shown in Appendix B.

	Sound Pressure Level (dB), in each Frequency Band							
Receiver	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Design Range NR20	51	39	31	24	20	17	14	13
Calculated Noise Level	39	33	30	23	19	13	7	-

Table 6.1: Noise levels and criteria at ground floor

As shown in Table 6.1 and Appendix B, noise transmission to bedrooms would be expected to comply with the criteria, in terms of spectral levels.

7.0 GENERAL

If the noise levels generated within the restaurant are higher than assumed in this report then it may be necessary to install a limiter to restrict noise levels at certain frequency bands, or undertake upgrade works to the separating ceiling.

Loudspeakers should not be installed rigidly to the walls in the restaurant and should be isolated by anti-vibration mounts.

It is assumed that no destructive works will be undertaken to the floor as tested. Where any works are undertaken on the 1st floor, it is assumed this will be undertaken to a high level of detailing and workmanship.

8.0 CONCLUSION

An assessment of a separating floor has been undertaken at Roysia House, John Street, Royston in order to predict the suitability of the site for residential development.

The measured sound insulation performance of the floor has been used in conjunction with expected noise levels due to the restaurant in order to predict the resulting noise level within proposed residential spaces.

Measurements and calculates demonstrate that the existing floor separation is expected to achieve recommended internal noise levels for the proposed development according to BS 8233:2014, and further spectral criteria as recommended herein.

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APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for not more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise

L_{90}

This is the level exceeded for not more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 10 sources produce a 10dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

APPENDIX B

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Roysia House, John Street, Royston

Acoustic Calculation used for Room to Room Transmission:

$$SPL_{receiver} = SPL_{source} - SRI_{separation} + 10\log_{10} S - 10\log_{10} A$$

Receiver: Proposed 1st Floor Apartments
Source: Existing Ground Floor Restaurant

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Typical loudest internal noise level Levels within similar sized restaurant	75	76	77	76	80	77	71	62	83
Measured Sound Reduction of existing floor dB	-32	-39	-43	-49	-57	-60	-60	-64	
Correction for area of floor (S = 12m^2)	11	11	11	11	11	11	11	11	
Correction for receiver room absorption (α = 0.5)	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level at receiver due to transmisison of noise	**39**	**33**	**30**	**23**	**19**	**13**	**7**	**-6**	**26**
Design Range (NR20)	**51**	**39**	**31**	**24**	**20**	**17**	**14**	**13**	